1990 PHOTO SURVEY OF HARDWOOD MORTALITY : ED HAYES DNR-MN

The purpose of this survey was to assess the impact of drought conditions from 1987 to 1990 in upland hardwood stands in four central Minnesota counties.

Aerial Photography

On September 1, 1990, 35mm CIR photos were taken along four transects in each of the following counties: Douglas, Stearns, Kanabec and Cass/Crow Wing. Coverage was non-stereo the scale was 1:40,000. The film used was Kodak 2443 Batch 335, exposed through a Tiffen 12 filter and a CC40B filter. Image quality was good to excellent. The film was developed into slides for interpretation at a projected scale of about 1:1,900. Approximately 1250 slides covering about 7 percent of the gross area in these five counties were obtained.

Sampling Method

Although the sampling method employed used reasonable assumptions, limitations prohibited use of statistical measures of reliability. The units of interest for this survey were "stands of upland hardwoods, pole-size and larger" and the parameter estimated for each sampled unit was "percent tree mortality" (dead divided by the sum of live plus dead x 100). Four mortality classes were chosen to match those of the MN DNR Cooperative Forest Assessment(CFA) Phase II Inventory. These classes are: LOW (0-10% mortality), MEDIUM (11-25% mortality), HIGH (26-50% mortality) and EXTREME (51% + mortality). Stands, as sampled, had variable sizes but were at least 5 acres. This corresponds to the minimum stand size of the CFA inventory. Photo interpretation and ocular estimates of mortality were used to distinguish stands of interest. Stands were selected for sampling by projecting each slide onto a transect line and counting all(and only) stands of interest that intersected the line. A new stand would be distinguished and counted along the transect whenever the mortality class changed or the line was intersected by a forest type other than Merchantable-sized upland hardwoods (5 acres minimum).

Interpretation

No attempt was made to "ground truth" the photo-derived classifications. Instead, this study relied upon the photo interpretation ability of an experienced forester. Texture and color were the two main elements used to distinguish large-crowned upland hardwoods and mortality trees. Initially, 1-acre training samples were chosen for individual tree counts of both live and mortality trees. This greatly improved the ocular estimating ability of the interpreter. A grid of 5-acre cells adjacent to the transect line aided in determining minimum stand size. Due to limitations of the photography, oak species could not be distinguished from other hardwood species. No attempt was made to count 1990 mortality separately from previous years' mortality even though they could be distinguished on the photos.

Baseline Reference

For comparison purposes, a pre-survey "base line" level of mortality in these counties was established using the CFA stand data for state lands. Most of the CFA stand mortality estimates were obtained from field observation between 1980 and 1989. These data indicate a "normal" average stand mortality in the LOW (0-10%) category for upland hardwood pole-size and larger stands. For all five counties combined, they also indicate that 91 percent of the stands had LOW mortality, 7 percent had MEDIUM(11-25%) mortality and 2 percent had HIGH (26-50%) mortality.

Combined County Results

The photo interpreted estimates of percent tree mortality were summarized for all counties combined and for each individual county. The combined summary indicates a slight increase in the number of stands having greater than normal mortality. The proportion of MEDIUM and HIGH mortality stands increased to 11 percent and 3 percent respectively.

Cass and Crow Wing Counties

For these counties the county-wide photo survey results indicate no significant change in the distribution of stands by mortality class. However, Cass County differed from Crow Wing in that two locations in Cass County seemed to have greater mortality than average. Within these two areas the proportion of MEDIUM and HIGH mortality stands increased to 30 percent and 11 percent respectively. One of these areas is west of Leech Lake, between Cass Lake and Ten Mile Lake and the other is south of Gull Lake.

Douglas and Kanabec Counties

The mortality in these counties increased somewhat from a lower than average pre-survey baseline. The proportion of MEDIUM mortality stands increased to 13 percent in Douglas and 15 percent in Kanabec Counties. This does not translate into a great increase in the average stand mortality in these counties which could be estimated as about 7% using class midpoints.

Stearns County

The results for Stearns County show the greatest mortality of all five counties. This is also the county where oak is one of the dominant hardwood species. County-wide, the MEDIUM and HIGH classes increased to 30 percent and 11 percent respectively. Five percent of the stands sampled actually had EXTREME (51+ %) mortality and one percent of the stands were greater than 80 % mortality. Stearns County also had a location with much greater mortality than the county as a whole. This area extended for about 2 miles along the flight line south of Birch Lake. Using class midpoints, the average stand mortality county-wide and for this worst area is about 12% and 32% respectively.

Summary

The goal of providing a meaningful "windshield survey" of hardwood mortality in these five counties was obtained. The results indicate that broad mortality levels could be distinguished on the photos and that Stearns County has the highest level of hardwood tree mortality. Also, Stearns County was the only area where mortality was observed to be significantly grouped or clumped together. These clumps where from 1 to 3 acres, primarily in stands classed with EXTREME mortality.

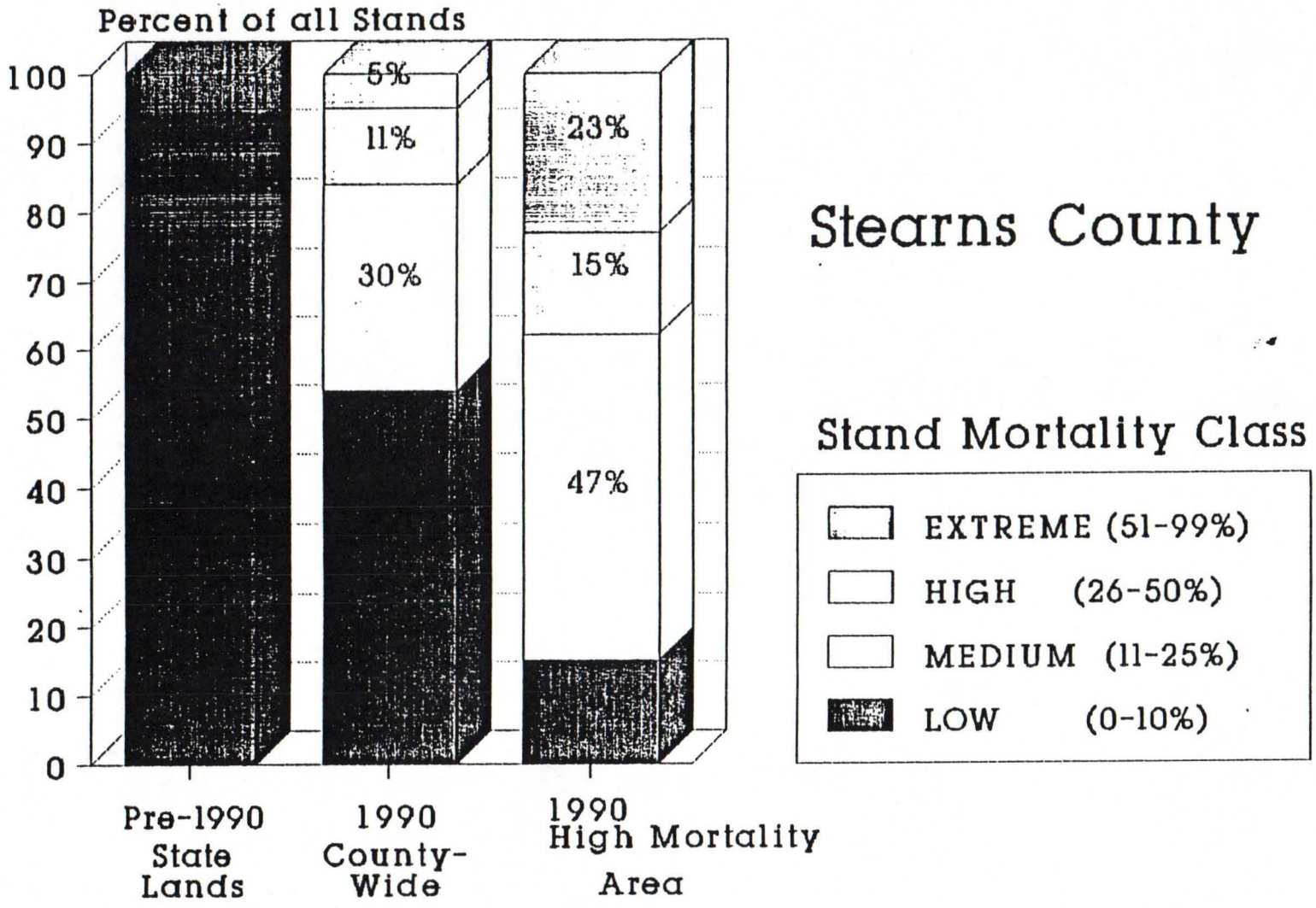
Pre-1990 Base-Line Data (CFA-State Lands)

Number Of Stands						
	Stand Mortality Class					
	LOW	MEDIUM	HIGH	EXTREME		
County	0-10%	11-25%	26-50%	51-80%	80+ %	Total
Cass	2,186	221	42	3	0	2,452
Crow Wing	511	32	2	0	0	545
Douglas	29	0	0	0	0	29
Kanabec	583	17	4	0	0	604
Stearns	21	0	0	0	0	21
Total	3,330	270	48	3	0	3,651

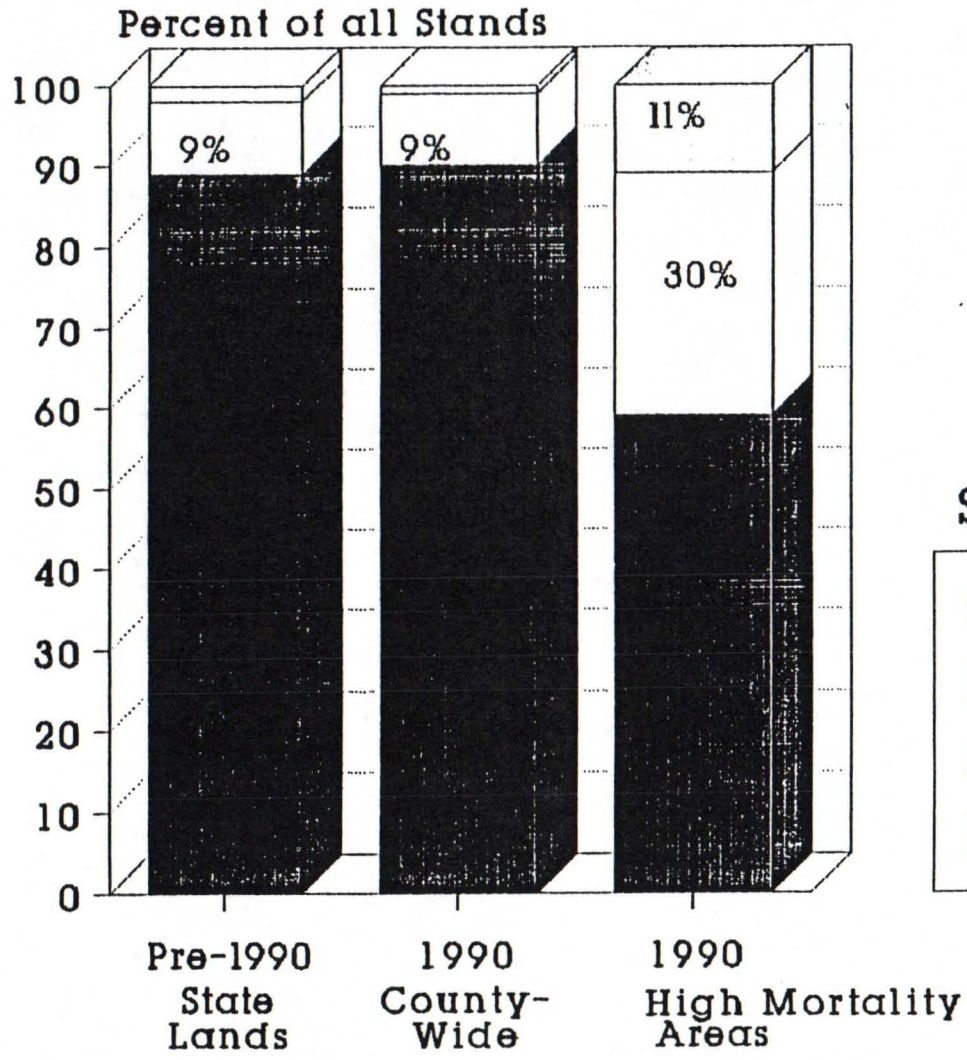
1990 Visual Photo Survey Data

Number Of Stands						
	Stand Mortality Class					
	LOW	MEDIUM	HIGH	EXTREME		
County	0-10%	11-25%	26-50%	51-80%	80+ %	Total
Cass	399	40	5	0	0	444
Crow Wing	120	1	1	0	0	122
Douglas	62	9	1	0	0	72
Kanabec	193	35	3	0	0	231
Stearns	40	22	8	3	1	74
Total	814	107	18	3	1	943

TREE MORTALITY BY PERCENT OF STANDS AND STAND MORTALITY CLASS



TREE MORTALITY BY PERCENT OF STANDS AND STAND MORTALITY CLASS

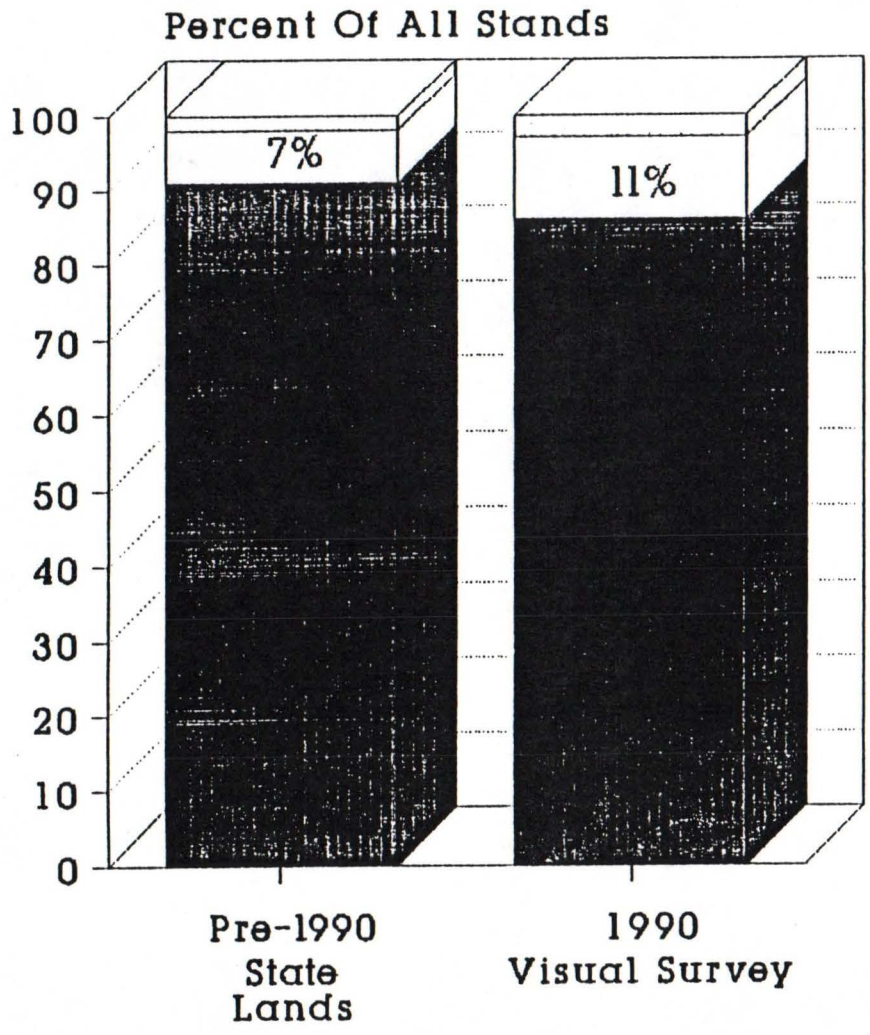


Cass County

Stand Mortality Class

- EXTREME (51-99%)
- HIGH (26-50%)
- MEDIUM (11-25%)
- LOW (0-10%)

TREE MORTALITY BY PERCENT OF STANDS AND STAND MORTALITY CLASS



Stearns, Cass, Kenabec

Douglas, Crow Wing

(Five county Combined)

Stand Mortality Class

HIGH	(26-50%)
MEDIUM	(11-25%)
LOW	(0-10%)